FOOD HABITS OF BULLFROGS IN NORTHWEST OHIO[1]

RICHARD L. BRUGGERS

Department of Biology, Bowling Green State University, Bowling Green, Ohio 43403

ABSTRACT

The stomach contents of 132 bullfrogs, *Rana catesbeiana* Shaw, collected monthly from July 1970 to June 1971, were identified and quantified. Members of 16 invertebrate and five vertebrate orders were observed. Of these orders, insects (nine orders) and crayfish were the most frequently observed food items. Snails, turtles, small rodents, salamanders, and fish also were present. No vertebrate or crayfish remains were observed in frogs weighing less than 50 g.

Seasonal variation in foods taken, especially in regard to the insect orders, was apparent, with utilization seeming to parallel availability; 20 percent more families of all food organisms were found in spring diets than in those of other seasons. Findings appeared to demonstrate the bullfrog to be an opportunistic predator.

INTRODUCTION

The bullfrog (*Rana catesbeiana* Shaw) is a widely dispersed species throughout the United States, native to the eastern half and introduced in the west. That the "bullfrog will eat almost any moving object that it can swallow or partially swallow" (Dickerson, 1969) is evident from the studies and feeding observations concerning this species (Cohen and Howard, 1958; Korschgen and Moyle, 1955; Perez, 1951). The purpose of the present study was to compare feeding patterns of bullfrogs in northwest Ohio with those in other parts of its range.

Korschgen and Moyle (1955) provide a literature review of bullfrogs' food habits in conjunction with their comprehensive study of bullfrog feeding habits in central Missouri. In their study, insects, crayfish, and frogs were the most common food items, but rodents, snails, tadpoles, and arachnids occasionally were eaten. They also cite the occurrence of turtles, small water-birds, sparrows, a coral snake, and an alligator in bullfrog diets. Food items listed by others include salamanders, feathers, worms, rabbit pellets (Cohen and Howard, 1958), and a towhee (Howard, 1950).

[1]Manuscript received December 4, 1972.

MATERIALS AND METHODS

In conjunction with an eye-lens-ageing study of the bullfrog (Bruggers, 1971), the stomachs of 158 of the adult frogs were examined. The frogs were collected at night from July 1970 to June 1971 from two ponds in Steidtmann Wildlife Sanctuary, Wood County, Portage, Ohio (located seven miles south of Bowling Green, at 83°39′20″W longitude and 41°18′20″N latitude).

In the present study, following fixation of the entire animal in 10 percent formalin, and after weighing, measuring, and internally sexing the animals, the stomachs were removed and the contents washed with water. Organisms in stomach contents were identified, counted, and in some cases weighed or measured. Small stones and vegetation were also found in some stomachs, but their presence usually was not quantified. Only those frogs (132) in which food items were present in the stomachs are included in the data summaries presented in this paper.

RESULTS AND DISCUSSION

It is evident from the results of this study (Table 1) that the bullfrog will indeed eat almost anything it can swallow. Representatives of 16 invertebrate and 5 vertebrate orders were identified from the stomachs of the 132 bullfrogs.

TABLE 1

Stomach contents of 132 bullfrogs, Rana catesbeiana, *collected between July 1970–June 1971 from Wood County, Ohio. Number (frequency) and percent* of stomachs in which food items occurred is indicated.*

	N=32			N=51			N=49			N=132	
	Apr.–May 1971			June 71, July–Aug. 70			Sept.–Oct. 70			Yearly total	
	freq.	%	No. Fam.	freq.	%	No. Fam.	freq.	%	No. Fam.	freq.	%
INVERTEBRATA											
ARTHROPODA											
INSECTA (Total)	24	75.0	24	49	96.0	22	38	78.0	17	111	84.0
Coleoptera	22	69.0	11	16	31.0	6	18	37.0	7	56	42.0
Lepidoptera				2	4.0	1	2	4.0	2	4	3.0
Trichoptera	3	10.0	2							3	2.0
Plecoptera	1	3.0	1							1	1.0
Hymenoptera	4	13.0	4	13	26.0	5	2	4.0	2	19	14.0
Odonata	2	6.0	1	7	14.0	4	5	10.0	2	14	11.0
Orthoptera	1	3.0	1	5	10.0	2	1	2.0	1	7	5.0
Hemiptera	3	9.0	3	8	16.0	3	3	6.0	2	14	11.0
Diptera	2	6.0	1	2	4.0	1	1	2.0	1	5	4.0
OTHER ARTHROPODA											
Diplopoda	1	3.0	1	1	2.0	1	3	6.0	1	5	4.0
Chilopoda							1	2.0	1	1	1.0
Isopoda	4	13.0	1	1	2.0	1	1	2.0	1	6	5.0
Arachnida	2	6.0	1							2	2.0
Decapoda	4	13.0	1	1	2.0	1	8	16.0	1	13	10.0
ANNELIDA							1	2.0	1	1	1.0
MOLLUSCA											
Gastropoda	2	6.0	2	3	6.0	2	5	10.0	2	10	8.0
VERTEBRATA											
Ambystomatidae							2	4.0	1?	2	2.0
Ranidae	3	9.0	2	1	2.0	1	1	2.0	1	5	4.0
Testudinidae	2	6.0	1							2	2.0
Pices	1	3.0	1							1	1.0
Rodentia											
Microtus							1	2.0	1	1	1.0
Mus	1	3.0	1							1	1.0
TOTAL FAMILIES			35			28			27		

*Greater than 100 percent since items from more than one order were in some stomachs.

Insects, represented by nine orders, were the most prevalent food item, being found in more than 96 percent of the summer-collected frogs and in 84 percent of frogs collected during the entire year (Table 1); these results are similar to those of other studies (Perez, 1951; Korschgen and Moyle, 1955). Coleopterans (12 families) were the most common insects during each season, being found in an average of 42 percent of all stomachs of frogs collected during the entire year, a value quite similar to the 44 percent found by Cohen and Howard (1958). Carabid beetles were the coleopteran most often observed (in 13 percent of the bullfrog stomachs), except during the spring. The stomach of one summer-collected frog contained exclusively at least 22 *Terasticus* sp. (1.5 g dry weight); no more than three were found in any other frogs during the year. Other coleopterans (gyrinids, dytiscids, and hydrophylids collectively) were observed in only 12 percent of the stomachs during the year.

Of the other insect orders, hymenopterans (14 percent yearly) and hemipterans (11 percent yearly—primarily *Gerris* spp.) were observed the most often, appearing mainly in summer-collected frogs (Table 1). Approximately four percent of the frogs had eaten wasps, with one frog having eaten eight individuals of *Vespula* sp. Ants also were present in about nine percent of the stomachs.

Both metamorphosing and non-metamorphosing dragonfly naiads were consumed by June-collected frogs and were the only item in four of the seven stomachs examined. As naiads usually emerge onto emergent vegetation (*Typha* or *Salix*) during metamorphosis in June and July, opportunistic predation of a readily available food is suggested. However, Corixidae and Notonectidae, although abundant in the ponds during the summer and fall, were found in only one stomach, a situation similar to that observed by Korschgen and Moyle (1955).

Crayfish (*Orconectes* sp.) were found only in frogs greater than 144 g body weight and were the second most commonly observed food item after insects (yearly 10 percent; fall 16 percent). Insects usually were present with these larger food items; for example, three crayfish, two carabid beetles, and several physid snails were present in the stomach of a single September-collected frog.

Small frogs and tadpoles, as bullfrog food, appeared mainly in the spring diets, although they were infrequent (4 percent) yearly. Together with crayfish and turtles, they were among the first food organisms available to the emerging larger adult frogs. One recently emerged adult bullfrog was observed eating a leopard frog. Two turtles (9.4 g total wet weight), a dytiscid, a moth, a fish, and a stone (total wet weight 33.2 g) were present in a gravid (367 g wet weight) female caught in May.

Rodents were found in the stomachs of two large bullfrogs, a *Microtus* in October and a *Mus* (hind foot: 22 mm) in May. The stomach of the frog (430 g) with the *Mus* also contained a crayfish. No vertebrates were found in frogs weighing less than 50 g body weight.

Representatives of 35 families were found in the spring diets, far more than in either summer or fall, apparently indicating utilization of the greater variety of food during that season, as it became available. Seasonal food-habit changes and utilization of food from both aquatic and terrestrial habitats was evident. The diverse diet of the bullfrog in northwest Ohio thus characterizes this animal as an opportunistic carnivore.

ACKNOWLEDGMENTS

I am grateful to Dave Alderfer for his assistance during the collections, to Drs. Karl Schurr and Robert Graves for their assistance in identifying some of the insects, and to Dr. W. B. Jackson for his helpful comments during the study.

LITERATURE CITED

Bruggers, R. L. 1971. The eye lens as an age indicator in the bullfrog, *Rana catesbeiana* Shaw. Unpubl. M.A. thesis, Bowling Green State Univ., Bowling Green, Ohio. 45 p.

Cohen, N. W., and **W. E. Howard.** 1958. Bullfrog food and growth at the San Joaquin experimental range, California. Copeia 1958(3): 223–225.
Dickerson, M. C. 1969. The frog book. Dover Publ., N. Y. 253 p.
Howard, W. E. 1950. Birds as bullfrog food. Copeia 1950(2): 152.
Korschgen, L. S., and **D. L. Moyle.** 1955. Food habits of the bullfrog in central Missouri farm ponds. Amer. Midl. Nat. 54(2): 332–341.
Perez, M. E. 1951. The food of *Rana catesbeiana* Shaw in Puerto Rico. Herpetologica 7(1): 102–104.